COMPREHENSIVE REVIEW OF CARDIOVASCULAR DISEASES AND THEIR RISK FACTORS

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Abstract

Cardiovascular diseases (CVDs) are the one of the most leading cause of mortality and disability throughout the globe. According to World Health Organization information, chronic illnesses such as coronary heart disease, cancer, diabetes, and obesity account for 59% of the 56.5 million weaknesses recorded. With coronary heart disease ranking as the leading cause of morbidity and death globally, it is not surprising that much research is currently focused on finding novel therapeutic options to prevent and cure this illness.

Introduction

Cardiovascular diseases (CVD) are a significant source of morbidity and mortality worldwide, with ischemic heart disease and stroke accounts for 24% of all fatalities in 2010 (**Lozano *et al.*, 2012**). Approximately 80% of these CVD fatalities occur in low and middle-income nations (**WHO, 2016**). CVD rates have reduced in developed countries as a result of significant public health initiatives and improved preventive care, but they continue to be a key contribution to the rising burden of noncommunicable illnesses in developing countries (**Jami Husain *et al.*, 2020**). CVD already accounts for about 27% of all fatalities in India, suggesting a fast epidemiological shift (**Yadav *et al.*, 2014**). Modifiable CVD risk factors (such as cigarette usage, levels of physical activity, hypertension [BP], cholesterol levels, and hyperglycemia) are widespread and may be effectively addressed via public health and therapeutic treatments (**Barnes, 2013**).

Conventionally, clinical management of Cardiovascular risk factors has been based on directing treatment at abnormal levels of individual risk factors (e.g., treating "hypertension" or elevated cholesterol levels), but guidelines around the world are constantly integrates the prediction of absolute CVD risk to evaluate whether preventive drugs should be initiated (**Malakar *et al.,* 2019**). The federal government of India has established the National Program for the Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS) (**Pencina *et al.,* 2019**).

Acute myocardial infarction seems to be the most serious type of ischemic heart disease, and it develops as a result of an unbalance between coronary blood flow and myocardial demand. Myocardial infarction (MI), often known as a heart attack, is a condition that happens when blood flow to a portion of the heart is disrupted, resulting in the loss of heart tissue. Acute MI is distinguished by various degrees of chest discomfort, perspiration, weakness, vomiting, arrhythmia, loss of consciousness, and even death (**Sah and Nagarathana, 2016**). High levels of blood cholesterol levels and low-density lipoprotein cholesterol, as well as low levels of high-density lipoprotein cholesterol, are linked with a greater risk of heart disease (**Kim *et al*., 2019**).

Myocardial Infarction (MI) is a complex illness influenced by genetics, hyperlipidemia, obesity, and hypertension, as well as environmental and lifestyle factors such as stress, smoking, and alcohol use. A balanced diet is essential for preventing or treating cardiovascular disease (**Mahajan *et al*., 2017**). Myocardial infarction causes an increase in mortality and morbidity in emerging countries as a result of lifestyle changes. Isoproterenol (ISO) is a synthetic catecholamine and β-adrenergic agonist that causes stress in the myocardium and damage to the myocardial membrane when oxidised by free radicals. Medicinal herbs have been shown to play a significant role in the treatment of a variety of human disorders, including cardiovascular disease.

Cardiovascular disease (CVD) refers to a group of pathologies that include coronary heart disease (CHD), cerebrovascular disease, peripheral arterial disease, congenital heart disease, and venous thromboembolism. Cardiovascular disorders account for 31% of global mortality, primarily in the form of coronary heart disease and cerebrovascular accident. Cardiovascular disease is not only the largest cause of death, but it is also the major cause of disability adjusted life years worldwide. CVD is linked to oxidative damage, which shares a general mechanism of molecular and cellular damage (**Benjamin *et al*., 2019**).

CVD refers to all heart and circulatory system disorders, including myocardial infarction, coronary heart disease, peripheral vascular disease, and stroke. Myocardial infarction is predicted to be the primary cause of death in cardiovascular disease. Myocardial infarction (MI) is a common occurrence in both men and women worldwide. It occurs when the myocardium's blood supply is insufficient, resulting in the death of cardiac muscle and the condition known as myocardial

ischemia. Myocardial ischemia that persists for an extended period of time culminates in necrosis, which is referred to as myocardial infarction (Reiner *et al*., 2019)

Myocardial infarction (MI) or acute myocardial infarction (AMI)

Acute myocardial infarction is characterised by abrupt chest discomfort (usually spreading to the left arm or left side of the neck), fatigue, nausea, vomiting, palpitations, perspiration, and anxiety (often described as a sense of impending doom). Women may suffer fewer of the standard symptoms than males, the most frequent of which are shortness of breath, weakness, dyspepsia, and tiredness. Around one-quarter of all myocardial infarctions are "silent," meaning they cause no chest discomfort or other symptoms (WHO, 2016). Worldwide, MI is the top cause of mortality for men and women. Significant risk factors include a history of cardiovascular disease, advanced age, tobacco use, elevated blood levels of certain lipids (triglycerides, low-density lipoprotein) and low levels of high-density lipoprotein (HDL), diabetes, hypertension, obesity, chronic kidney disease, heart failure, excessive alcohol consumption, substance abuse (such as cocaine and methamphetamine), and chronic kidney disease **(Ridker *et al*., 2017).**

Classification

Acute myocardial infarction is classified into two broad categories (Stewart *et al*., 2017).

❖ Transmural: characterised by atherosclerosis of the main coronary arteries. It is divided into anterior, posterior, inferior, lateral, and septal types. Transmural infarcts span the whole thickness of the heart muscle and are typically the consequence of the area's blood supply being completely cut off.

❖ Subendocardial: affecting a small portion of the left ventricle's subendocardial wall, ventricular septum, or papillary muscles. Subendocardial infarcts are believed to occur as a consequence of a locally reduced blood supply, perhaps caused by coronary artery constriction. The subendocardial space is the farthest away from the heart's blood supply and therefore more prone to this kind of disease. Myocardial infarction may be further divided clinically into ST elevation MI (STEMI) and non-ST elevation MI (non-STEMI) based on ECG alterations.

Myocardial infarction is further divided into five categories. (Figure-1) (Chapman *et al*.,

2017). Atherosclerotic plaque rupture causes irregular blood flow, platelet aggregation, and coronary artery occlusion, resulting in ischaemia and infarction in type 1 myocardial infarction. This phenotype is well-known, and there are evidence-based guidelines for both prevention and treatment that are shown to enhance clinical outcomes (Collet *et al*., 2020). In the absence of atherosclerotic plaque rupture, type 2 myocardial infarction is caused by an oxygen supply and demand imbalance. This usually happens as a result of a physiological stressor like tachyarrhythmia, hypoxia, or hypotension.

Type 2 myocardial infarction has significantly worse clinical outcomes. This can be explained in part by the patients' age and co-morbidities, but it could also be due to inadequate treatment of underlying coronary and structural heart disease (DeFilippis *et al*., 2019). Type 3 myocardial infarction subsequently leads to biomarker sampling in the case of abrupt death (Chapman *et al*., 2018). Type 4 myocardial infarction occurrences occur owing to percutaneous coronary intervention or as a result of stent thrombosis or in-stent restenosis. Following heart surgery, type 5 myocardial infarction occurs (Sandoval and Jaffe, 2019).

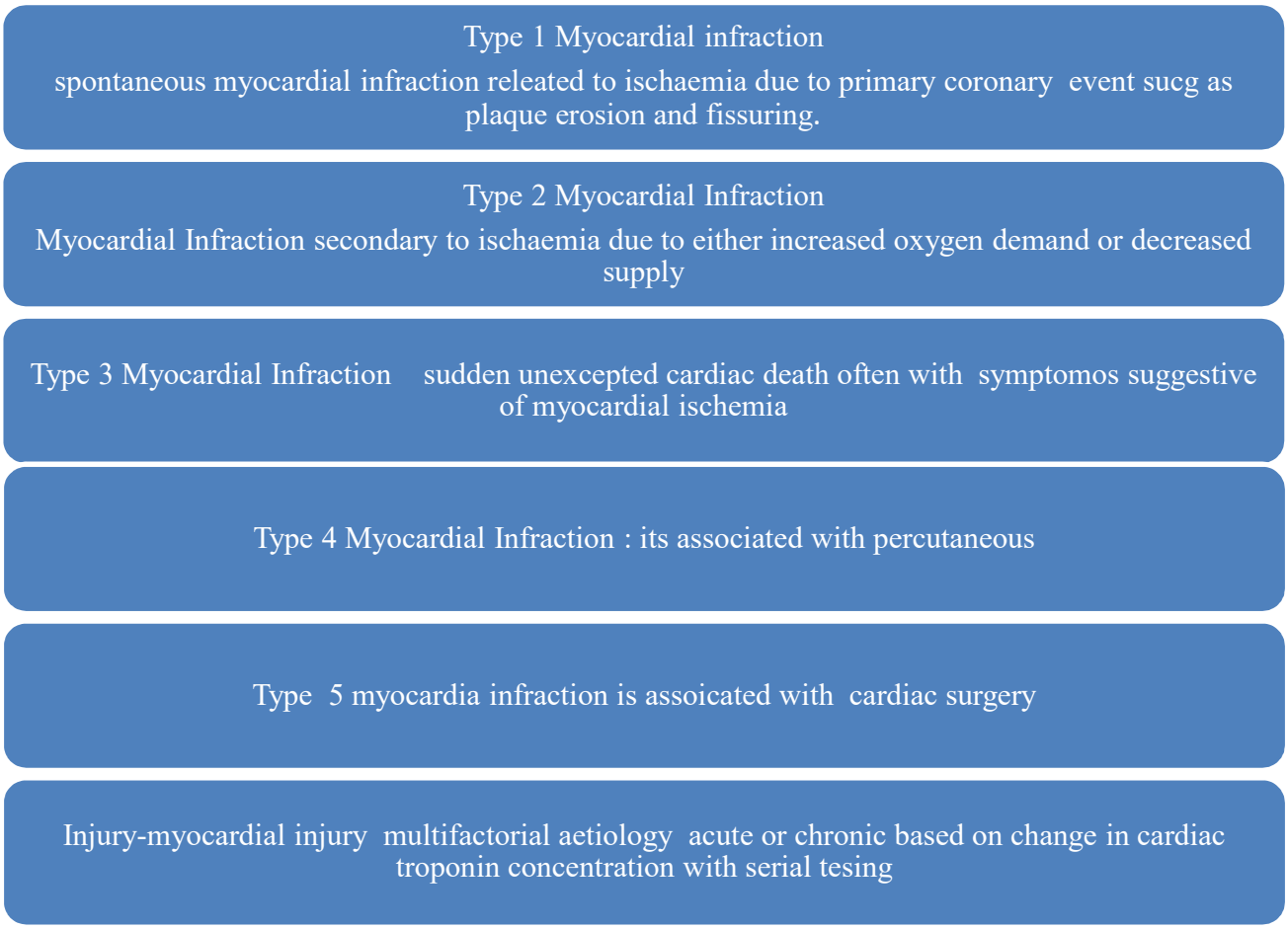


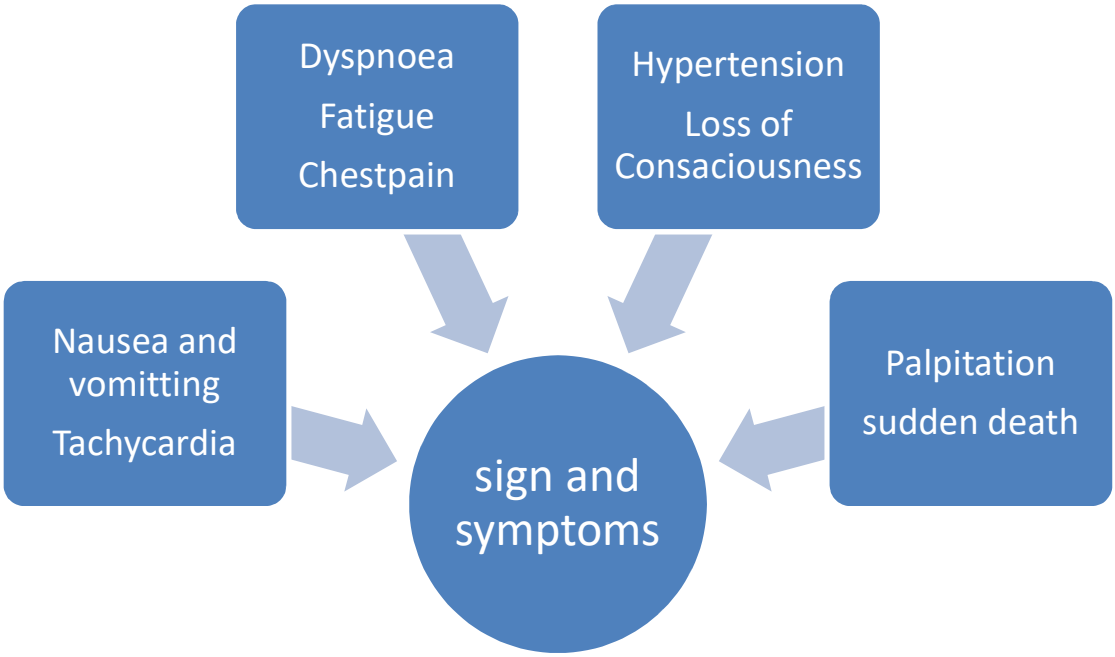
Figure1: Sub-types of myocardial injury and infarction as per the Fourth Universal Definition of Myocardial Infarction

Global CVD burden in men and women

The term "heart attack" is occasionally used erroneously to denote sudden cardiac death, which may or may not be the consequence of an acute myocardial infarction. A heart attack is distinct from, but may be the cause of, cardiac arrest, which is the cessation of the heartbeat, and cardiac arrhythmia, which is an irregular heartbeat. It is also different from heart failure, which occurs when the heart's pumping function is impeded; severe myocardial infarction may, but does not always, result in heart failure (WHO, 2016)

Symptoms and signs

Symptoms of a myocardial infarction (MI) typically appear gradually over many minutes and are seldom immediate (Figure-5). The most frequent sign of an acute myocardial infarction is chest discomfort, which is typically characterised as a tightness, pressure, or squeezing feeling. Angina pectoris is a kind of chest discomfort caused by ischemia (a lack of blood and therefore oxygen flow to the heart muscle). The pain usually radiates to the left arm, although it may also radiate to the lower jaw, neck, right arm, back, and epigastrium, where it might resemble heartburn. Levine's sign, in which the patient localises their chest discomfort by clenching their fist over the sternum, was formerly believed to be indicative of cardiac chest pain, however a prospective observational research found that it had a low positive predictive value.



Shortness of breath (dyspnea) develops when heart disease restricts the output of the left ventricle, resulting in left ventricular failure and pulmonary edoema. Diaphoresis (excessive sweating), weakness, light-headedness, nausea, vomiting, and palpitations are some of the other symptoms. These symptoms are most likely caused by a large surge of catecholamines released by the sympathetic nervous system in reaction to pain and the hemodynamic irregularities caused by heart dysfunction. Myocardial infarctions may cause loss of consciousness (due to insufficient cerebral perfusion and cardiogenic shock) and sudden death (often owing to the onset of ventricular fibrillation). Women and elderly patients report unusual symptoms at a higher rate than males and

younger individuals. Women also report a greater number of symptoms than males . Dyspnea (shortness of breath), weakness, and tiredness are the most frequent symptoms of MI in women. Fatigue, sleep difficulties, and dyspnea have been described as common symptoms that may appear up to one month before the clinically apparent ischemia episode. Chest discomfort in women may be less indicative of cardiac ischemia than in males.

Causes

Severe effort, whether psychological stress or physical exertion, is linked to a greater risk of heart attack, particularly if the exertion is more intense than the person is used to. For physically fit individuals, the period of intensive activity and subsequent recuperation is linked with a 6-fold greater myocardial infarction risk (relative to other more relaxed time periods). The rate difference is approximately 35-fold greater for individuals in low physical condition. The increased arterial pulse pressure stretching and relaxing arteries with each heartbeat is one recognised reason for this occurrence, which, as seen with intravascular ultrasonography, increases mechanical "shear stress" on atheromas and the probability of plaque rupture (Bouma *et al.*, 2013; Wobbe Bouma *et al.*, 2013).

Risk factors

In general, risk factors for atherosclerosis are also risk factors for myocardial infarction. Of course, these elements are often interconnected and hardly occur alone .

❖ Age – Men acquire an independent risk factor at the age of 45, and women acquire an independent risk factor at the age of 55; additionally, individuals acquire another independent risk factor if they have a first-degree male relative (brother, father) who suffered a coronary vascular event at or before the age of 55. Another independent risk factor is having a first-degree female family (mother, sister) who had a coronary vascular incident at the age of 65 or younger.

❖ Males are at a higher risk than females.

❖ Diabetes (with or without insulin resistance) (Shobana Devi and Shabana Begum, 2021)

❖ High blood pressure

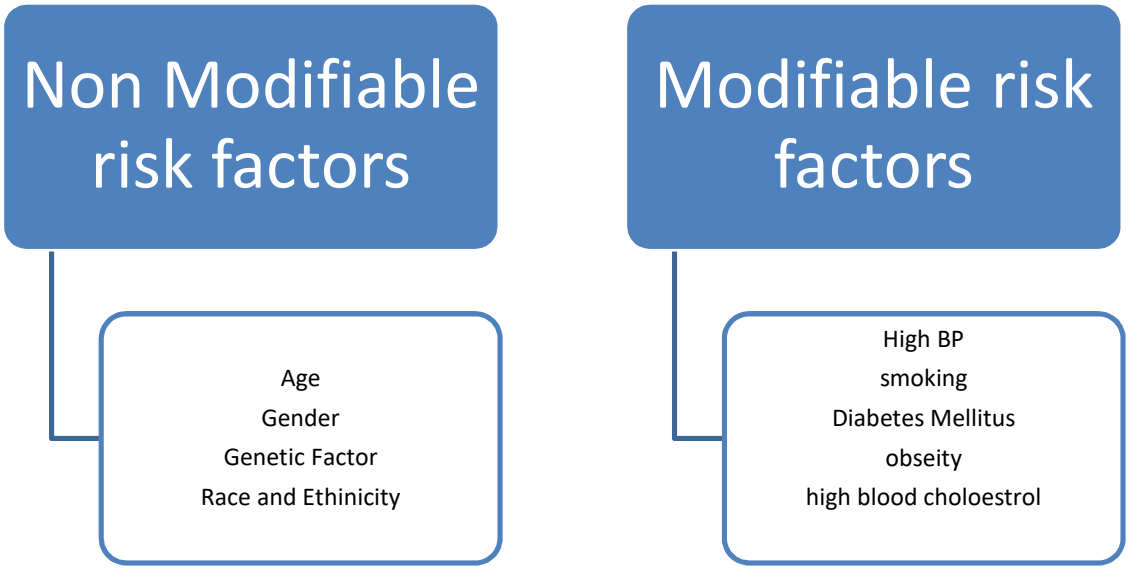
❖ Dyslipidemia/hypercholesterolemia (abnormal levels of lipoproteins in the blood), especially high low-density lipoprotein, low high-density lipoprotein, and high Triglycerides

❖ Tobacco use, especially second hand smoke; • Air pollution; and • A family history of ischemic heart disease (IHD)

❖ Obesity (measured by a body mass index of greater over 30 kg/m^2, or optionally by waist size or waist-hip ratio).

❖ Hyperhomocysteinemia (high homocysteine)

❖ Stress – It is well known that occupations with a high stress index are predisposed to atherosclerosis. (Malik *et al*., 2013)



Major modifiable and non-modifiable risk factors for cardiovascular disease

Prevention

The risk of recurrent myocardial infarction reduces with rigorous blood pressure control, frequent exercise, a heart-healthy diet, and moderate alcohol use. Following a MI, people are typically put on numerous long-term medicines to avoid subsequent cardiovascular problems including myocardial infarctions, congestive heart failure, and strokes. Unless contraindicated, these drugs include:

❖ Aspirin and/or clopidogrel should be maintained to minimise the risk of plaque rupture and

recurrent MI. Since aspirin is cheap and effective, clopidogrel is only used for individuals who cannot tolerate aspirin. The combination of clopidogrel and aspirin may decrease cardiovascular events, but increases bleeding risk **(Sessa *et al*., 2018)**.

❖ Begin beta blocker treatment with metoprolol or carvedilol. These are especially useful in high-risk individuals with left ventricular failure or persistent cardiac ischemia. -Blockers reduce death and morbidity. They also help NSTEMI patients' ischemic symptoms (**Moran *et al*., 2014**).

❖ In hemodynamically stable patients with a history of MI, diabetes, hypertension, anterior infarct site (as determined by ECG), and/or left ventricular dysfunction, ACE inhibitor treatment should be started 24–48 hours post-MI. ACE medications improve mortality, heart failure development, and ventricular remodelling after MI.

❖ Statin treatment reduces mortality and morbidity after MI. Statins may have benefits beyond reducing LDL. Statins, in addition to lowering blood lipids, have been shown to reduce the risk of myocardial infarction via stabilising plaque **(Russo *et al*., 2008**).

❖ Combined with conventional treatments, the aldosterone antagonist eplerenone has been demonstrated to decrease the risk of cardiovascular mortality in patients with heart failure and left ventricular dysfunction. Spironolactone is a cheaper alternative to eplerenone.

Management

MI is a medical emergency requiring urgent care. Treatment aims to save as much myocardium as possible and avoid future problems. Aspirin and nitroglycerin may be given. Morphine was traditionally given when nitroglycerin failed, however it may increase mortality in NSTEMI. A 2009 and 2010 study showed high flow oxygen increased mortality and infarct size, putting into doubt the regular usage advice. Other analgesics, such nitrous oxide, are unknown. STEMI patients should get PCI or fibrinolysis **(Mozaffarian *et al*., 2015)**.

Complications

Complications may arise quickly after a cardiac arrest (in the acute stage) or they can take time to evolve (a chronic problem). Acute complications may include heart failure if the damaged heart can no longer effectively pump blood throughout the body; aneurysm or rupture of the

myocardium; mitral regurgitation, especially if the infarction causes dysfunction of the papillary muscle; and arrhythmias such as ventricular fibrillation, ventricular tachycardia, atrial fibrillation, and heart block. Heart disease, cardiac arrhythmia, and a greater risk of a second myocardial infarction are long-term consequences (**Moreyra *et al*., 2010; Bouma *et al*., 2015**).

Conclusion

Heart disease is the primary cause of death globally. Cardio protection is the process of reducing or preventing myocardial damage in order to preserve the heart's function. Heart valve disease, endocarditis, aortic illnesses, hypertension, orthostatic hypotension, coronary artery disease, shock, atherosclerosis, arrhythmia, and congenital heart disease are examples of CVDs. The incidence of myocardial infarction fluctuates significantly amongst various cardiovascular conditions. For myocardial infarction, ischemia and reperfusion damage (MI/RI) are the most frequent causes. Concerning that plant foods are cheap and safe; researchers have looked into the preventive and therapeutic effects they have on cardiovascular disease.

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